

Subgradient

Nipun Batra

July 20, 2025

IIT Gandhinagar

- Generalises gradient to convex but non-differentiable problems

Subgradient

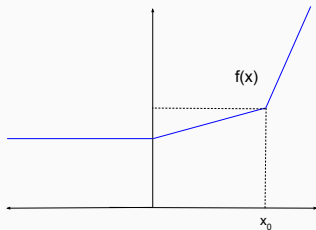
- Generalises gradient to convex but non-differentiable problems
- Examples:

Subgradient

- Generalises gradient to convex but non-differentiable problems
- Examples:
 - $f(x) = |x|$

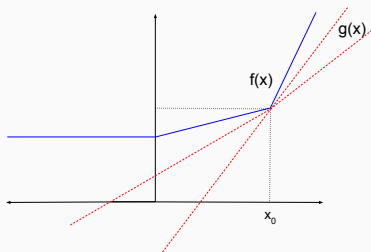
Task at hand

- TASK: find derivative of $f(x)$ at $x = x_0$



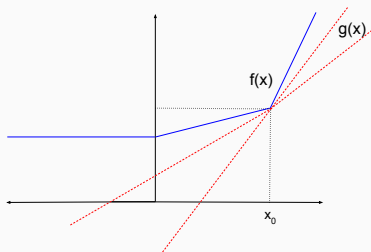
Solution

- Construct a differentiable $g(x)$



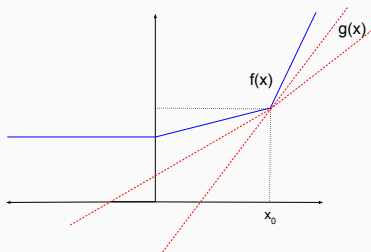
Solution

- Construct a differentiable $g(x)$
 - Intersecting $f(x)$ at $x = x_0$



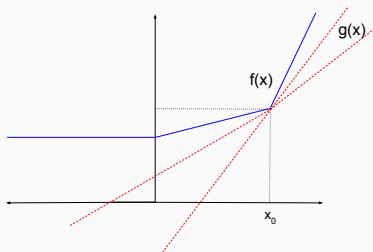
Solution

- Construct a differentiable $g(x)$
 - Intersecting $f(x)$ at $x = x_0$
 - Below or on $f(x)$ for all x



Solution

- Compute slope of $g(x)$ at $x = x_0$



Another Example: $f(x) = |x|$

- Subgradient of $f(x)$ belongs to $[-1, 1]$

